Algorithms, Data Structures & Complexity

Lab 3: Trees & Recursion

Due on first session of lab 4 for your group

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Handing In

This lab should be completed and shown during the first session of lab 4 for your group. The TA will pass by your seat and evaluate each exercise. Upon successful completion of the lab, for each lab exercise, please provide a text file named ex_n.txt with the following content:

- indicate which file(s) implement the algorithm and/or data structure in the exercise;
- a brief explanation of the tests that were carried out to test the implementation;
- instructions on how to execute a test to verify the implemented code;
- answers to any theoretical questions asked in the exercise.

Please submit all lab material collected into an archive (zip, rar, or tar.gz) via a Blackboard message to Uwe Köckemann and Federico Pecora.

Note: labs should be done in pairs. Larger groups are *not* allowed. All incidents of plagiarism will be reported. Please write your names on all material you hand in.

Exercise 1 — Binary Trees

- Implement a binary tree and provide all of the dynamic set operations (as listed in the book on page 230).
- Add functions to compute the depth and size of tree.
- Write tests for each operation to show that it works as intended.
- Use your binary tree implementation to realize an algorithm that, given a set of numbers, prints them out in sorted order.

Exercise 2 — Testing (I)

Test the program on the sorting problems provided with this lab:

1. Use the *load_file* function to load one of the provided files (see below) into an array
2. Create a binary tree containing all the numbers in the array
3. Print all numbers in sorted order

- The file *load_files.tar.gz* contains a small library to load files into an array
- The file *sorting_problems.tar.gz* contains files with random numbers between 10 and 100000 (and a python script to generate more problems)

Exercise 3 — Testing (II)

Once you have completed the lab, test an exercise of a colleague and report which tests you conducted and the results of these tests.